

AMENDMENTS TO THE SPECIFICATION

Please replace Paragraphs [0004], [0005], [0014], [0015], [0017], [0018], [0019], [0026], [0027], [0030], [0031] and [0035] with the following paragraphs rewritten in amendment format:

[0004] In short-time arc welding (also known as stud welding) elements such as metal studs are welded onto metal parts such as metal sheets. The studs serve as anchors for various fastening purposes. Accordingly, the studs may be configured as threaded studs (with metric thread), as coarse-threaded studs, pine tree studs, T-studs, etc. In the automotive industry, stud welding has been much used for some years. Here the stud welding technology serves to fasten body parts, to lay electric leads, to fasten carpeting, etc. Predominantly, in the automotive industry, robots are employed to achieve high productivity. ~~Here where~~ a stud welding unit is fastened to the end of a robot arm. The stud welding unit is connected to an electrical energy supply and to an automatic stud feeding device.

[0005] In ~~the~~ automotive industry, the so-called stroke ignition process is ~~used~~ especially ~~used~~. Here a metal stud is first placed in the location on the metal sheet where it is to be welded on. Then a so-called pilot current is switched on~~[,]~~ and the metal stud is lifted somewhat relative to the metal sheet. Thus an electric arc is set. Then the welding current proper is switched on ~~and the~~. The mutually opposed faces are incipiently fused by the high-energy electric arc. Then the metal stud is again lowered onto the metal sheet~~[,]~~ so that the respective melts will mingle. The arc is short-circuited. The combined melt solidifies~~[,]~~ and the welding operation is complete.

[0014] By maintaining the measure of realizing maintenance of the correct distance between the hand welding device and the part, or metal sheet, in that the housing of the hand welding device, or positioning means provided thereon, act directly on the welding gauge and do not contact the part itself at all, welding operations can be performed also in the area of curved locations. The positioning means, in all operating conditions[.,]] and particularly in the welding position, are offset to the rear relative to the anterior end of the holding means.

[0015] The welding gauge is rigidly mounted on the part[.,]] and itself has sufficient rigidity to ensure an exact positioning. Consequently, a supporting foot extending parallel as far as the anterior end of the holding means, or a corresponding nozzle, may be dispensed with. Consequently, welding operations may be performed even where the surface of the part is extremely curved in the immediate neighborhood. Consequently the bodywork designer has greater degrees of freedom in the arrangement of places where the studs are to be welded on. In this way, expense can be saved even at the design level.

[0017] In the hand welding device according to the invention, it is advantageous if the positioning means comprise at least one pin extending essentially parallel to the direction of action of the holding means. In this way, an exact positioning can be realized, particularly in an axial direction, with little engineering outlay on the hand welding device.

[0018] It is especially preferred if the positioning means comprise two positioning elements, in particular two pins. With two pins, the position of the hand welding device can be exactly oriented laterally as well, and to a large extent, the

manual welding device can be prevented from approaching the part obliquely. One or two pins will not indeed serve to achieve perfect tilting stability. This as this requires three pins. It has been found, however, that even with only one pin, better with two pins, it is possible for the user to position the hand welding device essentially perpendicular in relation to the part if the welding gauge provides sufficient axial guidance. Here it is of especial advantage if the two pins and the centerline lie at the vertices of an equilateral triangle, to which the axis is perpendicular. This symmetry results in a high stability over all.

[0019] According to a further proposal of the invention, provision may be made that the positioning means comprise three positioning elements, in particular pins, the end points of the positioning elements lying at the vertices of a triangle. By this conformation, stable support of the hand welding device on the welding gauge is assured, and so is an exact orientation of the centerline with the part. The element to be welded onto the part may therefore be welded to the part with great precision as to position and angle. Another advantage of this conformation is consists in that an axial guidance on the welding gauge may be dispensed with, so that the mounting of the hand welding device on the welding gauge and its removal therefrom is facilitated, thus simplifying handling.

[0026] In Figure 1, an embodiment of a welding apparatus according to the invention is generally designated 10. The welding apparatus includes a hand welding gun 12[,,] serving to weld an element in the form of a metal stud 14 onto a part in the form of a metal sheet 16. ~~To the metal sheet 16, a~~ A welding gauge 18 of plastic is

fixed, namely to the metal sheet 16 at schematically indicated fastening points 20 and 22. The welding gauge 18 may also be made of metal.

[0027] The hand welding gun 12 comprises a housing 30 and a grip 32. ~~On the housing 30, a~~ A holding means 34 is mounted~~[,]~~ on the housing 30 to hold one metal stud 14 at a time. The holding means 34 is mounted, more precisely speaking, on a reciprocating means arranged in the housing 30 and schematically indicated at 36. The reciprocating means 36 serves to advance and return the holding means 34 relative to the housing 30. In one embodiment, the reciprocating means 36 comprises a spring pre-stressing the holding means 34 in one direction, in particular in an approach direction, that is, towards the part 16. For motion in reverse direction, an electromagnet may be provided. Alternatively, the reciprocating means 36 comprises, for example, a linear electric motor.

[0030] The length of pins 42 are designed ~~as regards their length~~ to rest upon support means 50 on the welding gauge 18. In the embodiment shown, the support means 50 comprise two receivers 52 arranged side by side. In Figure 1, only one pin 42 is shown and consequently only one receiver 52. The receivers 52 are arranged neighboring to an opening 54 in the welding gauge 18. The opening 54 serves for introduction of the holding means 34 as far as the metal sheet 16. The opening 54 is in each instance definitely greater than the holding means 34. Hence it is possible to inspect the weld location even after the hand welding gun 12 has been set on.

[0031] The receivers 52 form stops for the pins 42, and consequently ensure that a predetermined distance 44 from the part 16 is maintained. Further, the receivers 52, as may be seen in Figure 1, are configured as blind holes, each of which has an

which's inside diameter matching ~~matches~~ the outside diameter of the pins 42. Consequently the receivers 52 serve also to position the hand welding gun 12 in a direction perpendicular to the centerline 58, namely to fix the weld location.

[0035] Although in general it is also possible to provide corresponding adjusting means on the positioning means 40, the arrangement of adjusting means on the welding gauge 18' is of advantage, since a fine adjustment is possible for each individual weld location. For in many cases, there is a plurality of metal studs 14 to be welded to a metal sheet 16. Hence a welding gauge 18 often contains a plurality of openings 54 and corresponding receivers 52. Because of the adjusting means on the welding gauge 18', the metal studs 14 can be welded on one after another, without need for adjustments of the welding gun 12 meanwhile. Figure 2 also shows that besides the opening 54', another receiver 60 may be provided. In particular when the receivers 52 can have only a short actual guidance, or none, a third receiver 60 can be used ~~recommends itself~~, in order to achieve a stable positioning of the hand welding gun 12 in all three coordinate axes relative to the metal sheet 16.